Trauma and Pathology in Western European Hominins: Implications for relative adaptability

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Introduction

While many examinations of Pleistocene remains include discussions of trauma and pathology, no study exists which provides a broad, comparative examination of over-all trauma and pathology throughout geographic and temporal dimensions in Western Europe. Studies of interpersonal violence and trauma within Pleistocene populations suggest that *H. neanderthalensis* experienced these phenomena to greater degrees than AMHS (Berger and Trinkaus, 1995; Zollikofer et al., 2002); however they do not compare *H. neanderthalensis* trauma to that experienced by early archaic *H. sapiens*. With regard to pathological conditions, the dearth of comparative research makes it unclear whether or not significant differences existed among *H. neanderthalensis*, archaic *H. sapiens,* and AMHS. The study of health and pathology within Pleistocene populations is somewhat difficult due to the fact that there are relatively few remains to examine, and those that are available are often very fragmentary. However, studies of the health and adaptability of Pleistocene species could produce valuable information to increase our understanding of the reasons for the disappearance of archaic *Homo* and the persistence of AMHS.

Geographic Distribution

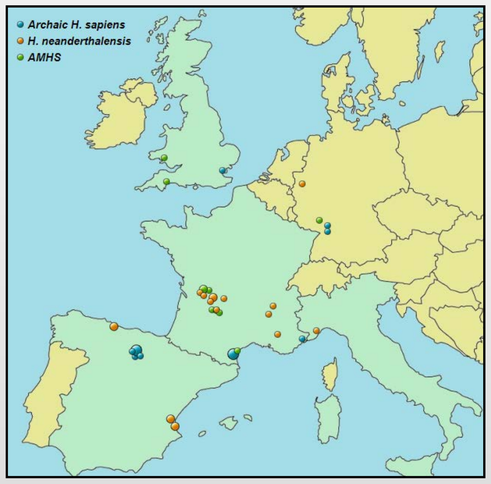

Figure 1: Map showing the geographic spread of examined hominin species. The color of the markers indicates the species found at the site. The size of the markers indicates the number of individuals found at each site.

Archaic *H. sapiens*

For the purposes of this study, the term "archaic *Homo sapiens*" will be used to refer to species of archaic hominins that have been classified as *Homo heidelbergensis* or *Homo antecessor*. Archaic *H. sapiens* will also refer to any species of indeterminate taxonomic status documented as "protoneanderthal" or "proto-*Homo sapiens,*" within the studies referenced. This term will help to focus on the study of trauma and pathology while avoiding taxonomic debates (Mounier et al. 2009; Stringer, 2012).

Figure 2: Skull 5 from Sima de los Huesos. Homo heidelbergensis specimen. Photo by José-Manuel Benito Álvarez.

Materials and Methods

This study is based on a comparative examination of existing literature detailing skeletal hominin remains from 32 Pleistocene sites in Western Europe. This region was chosen because a significant number of hominin sites are concentrated here. In order to gain a deeper understanding of health and pathology, samples were chosen from various geographic (Germany, France, Spain, the UK, and Italy) and temporal dimensions (from lower to upper Pleistocene). Table 1 includes greater detail on the sites and articles covered in this overview. Both healthy and pathological remains were considered in order to show the proportion of affected and unaffected individuals. Based upon the reported minimum number of individuals (MNI) from each resource, the total number of archaic H. sapiens included in this study was 71 individuals, the number of H. neanderthalensis was 63 individuals, and the number of AMHS was 28 individuals.

Materials and Methods Cont'd

Information on skeletal trauma and skeletal-dental pathologies was gathered from a number of resources. Where necessary, articles were cross-referenced with other publications in order to verify details such as taxonomic classification and MNI at each site. Due to the small number of available specimens, Fisher's exact test offered the most robust method of testing for statistical significance in the prevalence of the markers in each group. In order to gain a broader understanding of adaptability, Pleistocene populations were then compared to later hunter-gatherer groups who are understood to have been relatively well adapted to their biotic and abiotic environments (Eshed, 2010; Mithen, 2006). The over-all frequency of trauma within Pleistocene populations was compared to trauma in Natufian (Eshed et al., 2010) and Scandinavian (Fibiger et al., 2013) hunter-gatherer populations. The frequency of pathology in all Pleistocene populations was compared to the frequency of pathology in Natufian hunter-gatherer populations (Eshed et al., 2010). Finally, frequencies of Pleistocene dental pathologies were compared to the frequencies in various hunter-gatherer populations (Eshed et al., 2006; Turner, 1979; Larsen, 1997; Hutchinson and Norr, 2006; Lukacs and Pal, 1993; Hall et al., 1986).

Table 1: Skeletal Data

Species	Site	Date	MNI	# of Individuals w/ Trauma or Pathology	# of Individuals w/ no Trauma or Pathology	Sources
Archaic *H. sapiens*	Gran Dolina	780 ky	6	1	5	Arsuaga et al., 1999; Carbonell et al., 2005; Fernández-Jalvo et al., 1999
Archaic *H. sapiens*	Sima Del Elefante	1.0-1.3 my	1	1	0	Martinón-Torres et al., 2011
Archaic *H. sapiens*	Sima de los Huesos	530 ky	32	19	13	Gracia et al., 2009; Bonmatí et al., 2010; Bermúdez de Castro et al., 2003; Andrews and Fernández-Jalvo, 1997; Pérez et al., 1997; Arsuaga et al., 1991
Archaic *H. sapiens*	Atapuerca Trench	Middle Pleistocene	1	1	0	Bermúdez de Castro, 1992
Archaic *H. sapiens*	Lazaret	120 ky	2	1	1	Puech and Albertini, 1981
Archaic *H. sapiens*	Mauer	700 ky	1	1	0	Czarnetzki et al., 2003
Archaic *H. sapiens*	Steinheim	250 ky	1	0	1	Prossinger et al., 2003
Archaic *H. sapiens*	Swanscombe	400 ky	1	0	1	Oakley, 1957; Stringer and Hublin, 1999
Archaic *H. sapiens*	Caune de L'Arago	104 - >350 ky	26	0	26	De Lumley, 1977; Falguères et al., 2004
Neanderthals	Caverne della Fate	75-82 ky	2	1	1	Giacobini, 1984
Neanderthals	Le Regourdou	71-74 ky	2	1	1	Senut, 1985; Gómez-Olivencia et al., 2012 and 2013
Neanderthals	Cova Negra	Wurm	7	1	6	Arsuaga et al., 1989 and 2007
Neanderthals	Bau de L'Aubesier	Middle Pleistocene	4	4	0	Lebel et al., 2001; Lebel and Trinkaus 2001 and 2002
Neanderthals	Les Rochers	40.7 ky	1	0	1	Beauval et al., 2005
Neanderthals	Sima de las Palomas	40-60 ky	10	10	0	Walker et al., 2011
Neanderthals	La-Roche-à-Pierrot	36 ky	1	1	0	Zollikofer et al., 2002
Neanderthals	Moula-Guercy	100-120 ky	6	2	4	Hlusko et al., 2013; Brudvik et al., 2013
Neanderthals	La Quina	38 ky	4	1	3	Verna et al., 2010 and 2012
Neanderthals	La Ferrassie	40 ky	8	2	6	Berger and Trinkaus, 1995; Puech,
Neanderthals	La Chapelle-aux-Saints	60 ky	1	1	0	Trinkaus, 2011 and 1985
Neanderthals	Le Moustier	40-50 ky	1	1	0	Ponce de León and Zollikofer, 1999
Neanderthals	Neander Valley	40 ky	3	0	3	Schmitz et al., 2002
Neanderthals	El Sidron	Middle Pleistocene	13	2	11	Dean et al., 2013
AMHS	Cap Blanc	Upper Paleolithic	1	0	1	Dahlberg and Carbonell, 1961
AMHS	Kent's Cavern	44.2-41.5 ky	1	0	1	Higham et al., 2011
AMHS	Vogelherdhöhle	30.2-31.3 ky	3	2	1	Czarnetzki, 1980; Churchill and Smith, 2000
AMHS	Grotte de Lacave	Upper Paleolithic	1	0	1	Smith et al., 1999
AMHS	Fontéchevade	39 ky	2	0	2	Chase et al., 2007
AMHS	Les Eyzies	30 ky	4	3	1	Broca, 1868
AMHS	Paviland	18-22 ky	1	0	1	Jacobi and Higham, 2008
AMHS	Les Rois	28-30 ky	14	0	14	Ramirez Rozzi et al., 2009
AMHS	La Crouzade	31.9 – 29.3 ky	1	0	1	Henry-Gambier and Sacchi, 2008

Acknowledgements

Special thanks is given to Dr. Clark Spencer Larsen, Dr. Debbie Guatelli-Steinberg, and Dr. John Hawks for their advice and guidance in this project.

References

A large number of resources were used to create this report. A full list of references is available upon request

Results

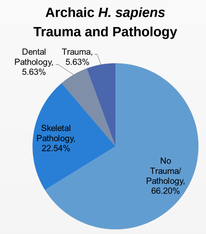

Figure 3: archaic H. sapiens trauma and pathology

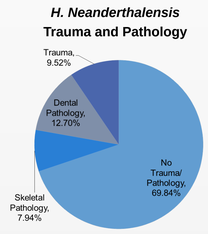

Figure 4: Neanderthal trauma and pathology

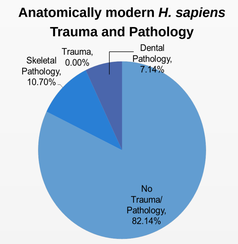

Figure 5: AMHS trauma and pathology

Table 2: Fisher's Exact Test of Differences in Frequencies of Skeletal Trauma

Species Compared	p-value
Neanderthal x AMHS	p = 1.00
AMHS x Archaic *H. sapiens*	p = 1.00
Neanderthal x Archaic *H. sapiens*	p = 0.5151

Natufian and Scandinavian hunter-gatherers exhibited a slightly higher frequency of trauma at 10.60% (62/578). The difference in trauma between Pleistocene hominins and hunter-gatherers proved to be not statistically significant (p = 0.2385).

Table 3: Fisher's Exact Test of Differences in Frequencies of Skeletal Pathology

Species Compared	p- value
Neanderthal x AMHS	p = 0.6978
AMHS x Archaic *H. sapiens*	P = 0.259
Neanderthal x Archaic *H. sapiens*	p = 0.0306

When the Pleistocene remains are pooled, the frequency of pathological conditions is 14.81%. This frequency is comparable to that exhibited by Natufian hunter-gatherers (13.5%). The difference between hunter-gatherers and Pleistocene hominins in this case is not statistically significant (p = 0.7624).

Table 4: Fisher's Exact Test of Differences in Frequencies of Dental Pathology

Species Compared	p-value
Neanderthal x AMHS	p = 0.0551
AMHS x Archaic *H. sapiens*	p = 0.5749
Neanderthal x Archaic *H. sapiens*	p = 0.2258

The over-all frequency of dental pathologies experienced by Pleistocene hominins is 7.41% (12/162), which is well within the range of dental pathology exhibited by Natufian and later hunter-gatherers. Dental pathologies in hunter-gatherers can range from being entirely absent to reaching percentages comparable to those exhibited in our Neanderthal specimens (Hutchinson and Norr, 2006; Lucaks and Pal, 1993) or higher (Hall Et al., 1986).

Discussion and Conclusions

Frequencies of trauma and pathology were relatively low in all Pleistocene hominin species. Although *H. neanderthalensis* exhibited slightly higher frequencies of head and neck trauma (Berger and Trinkaus, 1995), over-all trauma did not differ significantly from archaic *H. sapiens* or AMHS. This similarity in the frequency of trauma experienced by each species suggests that if behavioral differences did exist, they were not associated with differential risk of trauma.

When considering skeletal pathology, the difference between archaic *H. sapiens* and Neanderthals (p = 0.0306) suggest that archaic *H. sapiens* were more susceptible to infectious outcomes than Neanderthals. Our results suggest a lack of difference in skeletal pathology between Neanderthals and AMHS (p = 0.6978). If this is true and if infectious prevalence is a reflection of behavioral practices and adaptation to environmental pressures, these results support behavioral similarities between AMHS and Neanderthals (Herrera et al., 2009).

Frequencies of dental pathology were highest in *H. neanderthalensis* (12.69%), and some may have been a result of heritable traits (Dean, 2013). However, there was no statistically significant difference in dental pathologies among Pleistocene hominin species. These results suggest that despite dietary shifts between archaic hominins and AMHS (Richards and Trinkaus, 2009), each species was relatively well adapted to their respective diets. The similarity of dental pathologies also has implications for behavioral similarity due to the fact that eating hard foods or using the teeth as tools has been shown to cause excessive attrition that can lead to pathological conditions (Larsen, 1997: 77).

The pooled Pleistocene remains exhibit frequencies of trauma and dental-skeletal pathology that are within the range of trauma and pathology seen in later hunter-gatherers, who have been shown to be relatively healthy (Eshed et al., 2010; Mithen, 2006). This similarity in health status suggests that Western European Pleistocene hominins were probably behaviorally and biologically well adapted to their surroundings. While this study is by no means an exhaustive examination of all Pleistocene health, it provides further support for the idea that Pleistocene hominins had developed behavioral and biological methods of adapting to their environment. Thus maladaptation was most likely not a factor in the disappearance of archaic hominins.